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ABSTRACT

A study investigated whether metaphors help or hinder prose comprehension. The subjects, 71 college students, read eight short stories and rated their quality and the effectiveness of the writing. Approximately half of the subjects received stories that contained metaphors, while half received the same stories in which the metaphors had been replaced with literally equivalent statements. After reading the stories, subjects were given either a delayed or an immediate cued recall test. Analysis of recall protocols indicated an increased memorability for passages with metaphors. Not only were the metaphors themselves recalled better than the equivalent literal statements, but there was also an increase in memory for the context preceding the metaphors. (FL)

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Technical Report No. 259

THE ROLE OF METAPHOR IN PROSE COMPREHENSION

Ralph E. Reynolds, Robert M. Schwartz
and Joseph J. Esposito

University of Illinois at Urbana-Champaign

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University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, Massachusetts 02238

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The Role of Metaphor in Prose Comprehension

Learning in the modern school situation has a strongly literate bias. In fact, Olson (1977) has stated, "Schooling is a matter of mediating the relationship between children and printed text." From the beginning to the end of their school careers, children are expected to learn and recall information extracted from prose. Textbooks, workbooks and reference books are students' constant companions throughout their academic lives. Given this emphasis, it is hardly surprising that educators and psychologists have long been interested in understanding how various aspects of text affect learning and recall. Figurative language is one aspect of text that has a controversial function; the research presented in this article looks at the effect on learning resulting from the use of metaphor in texts.

Before proceeding, it should be noted that in investigating the pedagogical effects of metaphor, our inquiry is restricted to educational rather than literary metaphors. For purposes of this discussion, educational metaphors are defined by the primarily didactic nature of the context in which they occur. Literary metaphors are those used in poetry and the more artistic forms of literature. We make this distinction not because educational functions are considered more important, but because the two types of metaphors may interact with text in quite different ways; hence, it is necessary to study them independently.

Educators' interest in metaphor has centered on attempting to answer two questions. First, do metaphors affect prose comprehension? In other words, does the introduction of a metaphor into a passage tend to render

that passage more easily learned and recalled in comparison to the same passage without the metaphor? Second, given that metaphors are prevalent in children's literature (Arter, 1976), when do children develop the ability to comprehend these metaphors at a level comparable to their literal comprehension ability?

Considerable research has been conducted on the latter of these two questions, with inconsistent results. There are several reasons for these inconsistent results. They relate to the lack of an adequate theoretical notion of what constitutes "metaphor" and the weak relationship between the experimental tasks used and the phenomenon being investigated (Ortony, Reynolds, & Arter, 1978). There are also methodological problems resulting from the confounding of the ability to deal with general language variables such as indirectness and anaphoric reference with the ability to comprehend metaphorical language (Reynolds & Ortony, 1980).

The issue of whether metaphors affect comprehension and learning from prose by skilled readers is of both theoretical and practical importance, yet it has spawned little empirical research (Verbrugge & McCarrell, 1977). Recent research has dealt with two ways of using figurative language in the educational situation. The work of Hayes (Hayes & Tierney, 1980; Hayes, Note 1) suggests that analogies used as advance organizers can enhance comprehension of subsequent material. An example would be introducing a unit on electrical current by having students read a passage about water flowing through pipes. Of greater practical and theoretical interest is the work dealing with the effects on comprehension of metaphors that occur within text. The general findings of this work have been discouraging. Metaphors have been shown to have a positive effect on

prose comprehension in only a limited fashion. The metaphors themselves may be better recalled than their literal equivalents, but comprehension of incidental material seems unaffected (Arter, 1976; Pearson, Raphael, Tepaske, & Hyser, 1981).

Two major problems confront investigators interested in the effects that metaphors have on the comprehension of prose. First is the problem of knowledge about the domains of information to which the metaphor relates. If an individual does not know about lions, he/she cannot possibly understand the intended meaning in the statement, "The man is a lion." Second is the difficulty of constructing metaphors that can be easily paraphrased into literal statements. For instance, it is extremely difficult to paraphrase, "The man is a lion" with a literal sentence containing words of equal frequency and sentence construction of equal syntactic complexity. Yet, if these constraints are not met, the metaphor and its literal equivalent may differ in comprehension difficulty for reasons extraneous to the literal or non-literal nature of the statement. Beyond factors such as word frequency and syntactic similarity, there is also the problem of the lack of identity between the meaning of the metaphor and that of its literal paraphrase. For example, is it the intent of the statement, "The man is a lion" to convey the meaning that the man is brave or regal or vicious or carnivorous, or does it convey elements of all of these traits?

In the present research, these two problems have been addressed. With respect to background knowledge, adult rather than child subjects were used to enlarge the number of possible domains of knowledge that could be used in

the metaphors. In addition, all of the materials were normed to ensure that most adult readers would possess the requisite background knowledge.

The problem of equivalent literal paraphrases has been largely overcome by using context-dependent metaphors as stimulus materials (Ortony, Schallert, Reynolds, & Antos, 1978). A context-dependent metaphor is one in which a normal English sentence, such as "Regardless of the danger, the troops marched on," is either a literal statement or a metaphorical statement, depending on the context in which it appears. For example, in a story about a World War II battle, the sentence would probably be interpreted literally; however, in a story about two young children misbehaving and annoying their babysitter, the sentence should be given a metaphorical interpretation. Hence, a context-dependent metaphor is one that depends on surrounding information to determine how it will be understood. Since the metaphor is a complete, meaningful sentence, more nearly equivalent paraphrases are easier to construct (i.e., "Despite the babysitter's warnings, the children continued to misbehave."). Again as in the case of background knowledge, a norming study was done to ensure that the metaphors and the literal equivalent sentences conveyed approximately the same meanings.

There are at least two approaches that might describe the utility of metaphors as conveyers of information in educational texts. The first, the notion of general enhancement, is based primarily on the work of Ortony (1975; 1979; see also Breal, 1897). This work suggests that metaphors are necessary building blocks of language in that they allow ideas that were previously inexpressible to be expressed, frequently in a vivid, compact form. It is further supposed that the vividness of

metaphors, along with the way in which they are comprehended, tends to enhance the memorability of the metaphors themselves, as well as that of the information that appears with the metaphor. Hence, from this viewpoint, the use of metaphors in didactic discourse is considered not only a sign of linguistic elegance, but a sign of linguistic efficiency as well.

The second view, the non-facilitative approach, is based primarily on the work of Miller (1976), though elements of it can be traced as far back as Aristotle (McKeon, 1947). Miller has taken the stance that metaphors are used in educational writing only when the author is unable to be explicit or precise about the information he/she is interested in conveying. Here, metaphors are seen as stylistic devices that tend to gloss over the intended meaning. In this view, the use of metaphors in educational writing is seen as contributing only minimally to the learning and recall of the information conveyed by and presented with the metaphor.

These two notions provide a basis from which empirical predictions can be made. If metaphors enhance the learning and recall of prose material (i.e., general enhancement), then information from passages that contain metaphors should be better recalled than information from identical passages that contain literal equivalents of the metaphors. This superior recall should apply to the metaphors themselves, as well as to other passage information (Ortony, 1975). If, on the other hand, the non-facilitative approach is correct, recall of information from passages containing metaphors should be no better and perhaps even worse than recall of identical information from the literally equivalent passage.

The major purpose of this paper is to investigate the question of whether or not metaphors help or hinder prose comprehension. In reality

this question encompasses two questions. First, does the figurative nature of metaphor enhance memory for the metaphor itself? Second, does the inclusion of metaphor in prose enhance the comprehension of the information that appears with the metaphor? The present experiment attempts to answer both of these questions.

In the experiment, adults read eight short stories and rated their quality and the effectiveness of the writing. They were told that the materials would be used in a different study; hence, this study represents an incidental-learning task. After reading, the subjects were given either an immediate or delayed, cued recall test. Half the subjects received stories that contained metaphors, the other half received the same stories with literality equivalent statements replacing the metaphors.

Method

Design and Subjects

The design was a 2 (recall interval: immediate vs. 7-day delay) x 2 (cue type: precue vs. postcue) x 2 (target type: metaphor vs. literal equivalent) x 8 (passage) factorial design with recall interval, cue type and target type as between-subject factors and passage as a within-subject factor. The dependent measure was the amount of recall on the cued recall test.

The subjects were 71 college students enrolled in six sections of an introductory educational psychology course at a large midwestern university. They participated in the study for class credit. Three subjects were dropped from the study because they were not present when the delayed recall test was given; hence, in the analyses half of the eight cells contained eight subjects each while the other half contained nine.

Materials

The experimental materials consisted of eight short stories (mean length of 50 words), each of which ended with a summarizing statement (hereafter called the target). The target statement always appeared as the last sentence in the story. For half of the subjects, the target sentence in each story was a context-dependent metaphor; for the rest it was a literal paraphrase of the metaphorical target. A sample set of the components of one of the experimental stories will help demonstrate their nature.

Story Context:

The people of Nazi Germany were swayed by Hitler's rhetoric. Although he had committed his people to a course of war, he found it easy to persuade them of the virtue of his actions. Everyone in Europe at the time was aware of the consequences of war, but the Germans had a blind belief in Hitler.

Metaphorical Target:

The sheep followed the leader over the cliff.

Literal Paraphrase of the Metaphor:

The German people blindly accepted Hitler's dangerous ideas.

The eight experimental stories plus a cover page, general instructions, two practice stories, and a filler story were bound together into an 8 x 11-1/2 inch booklet. Each page of the booklet contained a story (context and target) and three 7-point scales on which the story was to be rated. The scales assessed the subjects' perceptions of how well the stories were written, how interesting they were, and what sort of impressions (e.g., negative or positive) the story elicited. The eight

experimental stories were randomly arranged for each subject. The practice stories always appeared first, while the filler story always appeared last.

Materials for the cued recall test were constructed as follows. For the precue condition, the first phrase (generally slightly shorter than the target sentences) from each story was printed in the upper left-hand corner of an otherwise blank piece of bond paper. These sheets were then combined into individual test booklets. Again, the order in which the cues were presented was randomized for each booklet. The post-cue booklets were constructed similarly except that the target sentences, either the metaphors or their literal paraphrases, were used as cues.

Two norming studies were run on these materials. The first was to determine if the two types of target sentences were equally memorable out of context. Thirteen subjects were given the metaphors and literal equivalent sentences printed on one piece of paper. They were told to remember as many of the sentences as they could. They were then given a five minute interpolated task followed by a recall test. Subjects were told to remember the exact sentence wording if possible, but if not to use their own words. There was no significant difference between recall of the metaphors or the literal equivalent statements (mean idea unit recall = 25% for metaphors, 24% for literals).

The second norming study dealt with how well the metaphors and literal equivalents conveyed the same meaning when presented in context. Twenty subjects read the context followed by both the metaphor and the literal equivalent statement. Subjects were then asked to rate whether or not the sentences conveyed the same meaning on a seven point Likert scale. On the scale, a rating of "1" represented identical meaning and a rating of

"7" represented no similarity in meaning. The average rating for all of the experimental stories was 2.48, S.D. = .4. In other words the norming subjects indicated that the stories containing metaphors and their literally equivalent statements conveyed essentially the same meanings.

Procedure

The experiment was conducted using six groups ranging in size from 5 to 20 students. As the students entered their classrooms, experimental booklets were randomly distributed. Three of the classrooms were used for the delay condition and three were given the immediate recall test. All other experimental conditions were represented in each classroom. When all of the subjects had received their booklets, the experimenter read the instructions out loud as the subjects read them silently. The instructions stated that the experimenters were trying to find good prose materials with which to do reading studies. The subjects were asked if they would read the stories and rate them for interest, quality of writing and impression created. It was stressed that the subject should read carefully. The subjects then proceeded through the booklets at their own pace.

When the subjects had finished reading, they were given five minutes to complete 40 items of the Wide Range Vocabulary Test (French, Ekstrom, & Prince, 1963). They were told that a measure of their vocabulary was necessary for the experimenters to evaluate their ratings of the stories. These scores were then used to ensure that no differences existed between the students used in the two recall-interval conditions. When all subjects had finished the vocabulary test, instructions for the recall test were given to those subjects in the immediate recall condition. Recall

instructions stressed that subjects should try to recall the exact words used in the stories, but if they couldn't remember the exact words, to use their own words instead. When subjects in the delay condition finished the vocabulary test, they were told that the experiment was completed and thanked for their cooperation. One week later, the experimenters returned to the delay subjects' classes and gave the recall test. Following completion of the recall test, all subjects were debriefed.

Scoring Procedure

A requirement of the present experiment was to measure both the quantity of information recalled and the fidelity of the protocols to the original texts. To achieve this, each protocol was scored for the number of idea units recalled on two levels: gist and verbatim. The use of idea units and levels of scoring has become a fairly common technique in prose research (e.g., Anderson & Ortony, 1975; Anderson, Reynolds, Schallert, & Goetz, 1977; Meyer & McConkie, 1973). However, since our procedures are slightly different than those previously used, a brief description of the scoring scheme will be given.

First, three independent judges divided the experimental stories into idea units (i.e., phrases or sentences that each represented a single thought or unit of information, or that significantly modified a previous unit). The judges agreed on 91% of the divisions, with all disagreements being settled in conference. Each subject's recall protocol was then scored for the presence or absence of idea units, according to a 4-point scoring system. Level 1 recall was exact reproduction of the source unit, except that tense changes were allowed. Level 2 recall was a close paraphrase of the source unit. Level 2 scoring allowed no more than one or two of the

non-essential words in the source unit to be paraphrased. Level 3 recall was a total paraphrase of the source unit; here, subjects could use any wording they chose as long as the meaning of the source unit was preserved. Level 4 recall was scored when material was judged to be definitely derived from a source unit, but was not explicit enough to be scored at any one of the previous levels. For purposes of the analysis, verbatim recall used only Level 1 scoring, and gist recall used all four levels.

Using this system, two independent judges scored each of the subjects' protocols. They agreed on 93% of the scoring decisions. All disagreements were settled in conference with a third judge.

Results

The subjects' ratings of how well the passages were written, how interesting they were and their tone were analyzed. The stories containing the literal paraphrase of the target metaphor were rated as better written, more interesting and creating a better impression than the stories that contained the metaphors themselves; however, these differences were not significant, $F < 1$. Analyses of the vocabulary scores established that there was no significant difference between the immediate and delayed recall subjects in terms of language ability, $F < 1$.

A 2 (recall interval) x 2 (cue type) x 2 (target type) x 8 (passage) unweighted means analysis of variance was performed using the amount of verbatim and gist recall as dependent measures. For the verbatim measure, significant main effects were found for recall interval, $F(1,60) = 57.62$, $p < .01$; and passage, $F(7,420) = 15.91$, $p < .01$. The recall interval effect was due to higher performance by immediate recall subjects than for the

7-day delay subjects. The passage effect resulted from differences in the memorability of individual passages. There was also a significant recall interval x passage ordinal interaction, $F(7,420) = 12.21$, $p < .01$. No other results reached significance, all p's > .20.

Table 1 shows the mean proportion of idea units recalled using gist scoring. This includes all idea units except those used in the cue. For the gist measure, significant main effects were found for recall interval, $F(1,60) = 91.25$, $p < .01$, target type, $F(1,60) = 9.46$, $p < .01$ and passage, $F(7,420) = 27.48$, $p < .01$. Again, the recall interval effect was due to superior recall by the subjects tested immediately after reading. The target-type effect was due to higher recall by those subjects who read passages that contained metaphors as opposed to those who read passages that contained the literal paraphrase of the metaphor. The passage effect resulted from differential memorability for individual passages. Significant interactions were found for recall interval x passage, $F(7,420) = 10.31$, $p < .1$, and recall interval x target type x passage, $F(7,420) = 2.32$, $p < .05$. These results were due to variability in subjects' treatment of the eight different experimental texts, but as can be seen from Figure 1, the effect for metaphor is evident in all passages but one. No other results reached significance, all p's > .24.

Insert Table 1 about here.

A second set of analyses were performed using data from only those subjects who received precues. These analyses looked at the recall of the target sentences alone for both the verbatim and gist dependent measures. For the verbatim measure, significant main effects were found for recall

interval, $F(1,30) = 20.96$, $p < .01$; target type, $F(1,30) = 7.89$, $p < .01$; and passage, $F(7,210) = 4.26$, $p < .01$. The target type result was due to greater recall of the metaphors than their literal equivalents. There were also significant interactions for recall interval x target type, $F(1,30) = 5.90$, $p < .05$; and recall interval x passage, $F(7,210) = 3.31$, $p < .01$. The recall interval x target type interaction was due to the difference between recall for literal or metaphoric target decreasing over time. The recall interval x passage interaction resulted from differences in memorability for individual stories and was ordinal in nature. No other results reached significance, all p's > .16.

Table 2 represents the mean proportion of target sentence idea units recalled using gist scoring. For the gist measure, significant main effects were found for recall interval, $F(1,30) = 29.94$, $p < .01$; target type, $F(1,30) = 9.90$, $p < .01$; and passage, $F(1,30) = 29.94$, $p < .01$. Significant ordinal interactions were found for recall interval x passage, $F(7,210) = 2.68$, $p < .01$; and recall interval x target type x passage, $F(7,210) = 2.91$, $p < .01$. No other results reached significance, all p's > .09.

Insert Table 2 about here.

Discussion

The pattern of results obtained in this study clearly supports the contention that metaphor can affect the processing of written language. Analysis of the gist scoring of the subjects' recall protocols indicates increased memorability for passages when the concluding statement is expressed metaphorically rather than literally. As shown in Tables 1 and 2, not only are the concluding metaphors themselves recalled better than

the equivalent literal sentences, but there is also an increase in memory for the preceding context. Figure 1 shows that these effects are consistent across the experimental passages. Thus, under certain circumstances and constraints, metaphors, like adjunct questions or advance organizers, can enhance learning from written text.

Insert Figure 1 about here.

The cautious wording of the previous statement reflects the preliminary nature of this study. Increasing the number of metaphors in a passage will not necessarily increase memorability, and it could just as easily make the text incomprehensible. Attempting to alter the text in this way is like trying to rewrite a college physics text to match the requirements of a fifth-grade readability formula. While the resulting text may have the desired formal characteristics in terms of sentence length and word difficulty, it will remain inaccessible to fifth graders unless proper consideration has been given to the requirements of processing new concepts.

Similarly, to specify the effect of metaphor on memory, it is necessary to develop explanations that are sensitive to processing factors. These explanations must be consistent with current models of text processing and information retrieval, able to account for different patterns of results given verbatim versus gist scoring, and suggest conditions under which metaphor will or will not improve memory. The present experiment was not designed to test a model of metaphoric processing, but it does provide data and a pattern of results that must be accounted for by such a model. The following discussion of possible processing models is designed to place qualifications on the generalizability of our primary finding and

to relate metaphoric processing to theoretical issues in the more general area of text processing. Both processing and retrieval explanations are considered since the study did not isolate the locus of the effect of metaphor or memory for prose; it only suggests that a facilitative effect exists in this context.

Kintsch and van Dijk (1978) present a fairly elaborate model for text processing. The basic component of this model is a procedure by which the reader attempts to validate the semantic integrity of his or her representation by relating new information to a limited set of propositions currently active in short-term memory. Failure to establish an argument match among propositions leads to an extended search through previously stored information until a match is obtained, or the activation of an inference process to try and generate the necessary match. The exact nature of arguments and propositions is not crucial (Kintsch & van Dijk, 1978), only the central premise that comprehension proceeds by relating the current input to stored information in order to maintain semantic coherence.

Within this model, memory for ideas from the text is hypothesized on two levels: the microstructure and the macrostructure. The microstructure consists of propositions that are close to the surface structure of the text, while the macrostructure is a more abstracted summary of the main ideas or gist of the text. The probability that a given idea from the text is recalled depends on the number of times it is activated by coherence processing. Memorability of macrostructure ideas depends also upon a relevance judgment based on the schema directing comprehension; that is, the reader's purpose or expectations invoked while processing the text.

Given this model of processing--or any other, for that matter--readers in the metaphor or literal equivalent conditions will come to the final sentence of text with essentially identical memory representation. According to Kintsch and van Dijk's (1978) model, subjects will have a currently active set of propositions in short-term memory and an established representation at the micro- and macro-levels. Now, given the metaphoric conclusion, the resulting increase in memory could reflect differential ease in establishing semantic coherence or differences in subsequent processing.

The former explanation assumes that subjects receiving a literal conclusion are able to establish semantic coherence quickly with few processing operations. Metaphoric processing, however, might invoke a search of stored propositions, and perhaps inference generation, in order to establish coherence. The additional activation of stored information and inferential processing in the metaphor condition could account for improved memory. This explanation, however, is in conflict with findings reported by Ortony et al. (1978) in terms of reaction times to understand a given concluding statement following a context requiring either a metaphoric or literal interpretation of the sentence. Given elaborate contexts similar to those used in this study, subjects responded at essentially the same speed whether the literal or metaphoric interpretation was required. Since subjects were instructed to respond as soon as they understood the concluding sentence, their reaction times can be taken as an indication of equal ease in establishing semantic coherence for metaphoric and literal conclusions.

That readers can as quickly interpret metaphoric and literal conclusions does not imply that they receive equal processing. Subsequent to initial comprehension, additional macro-level processing will be directed by the operative schema. The readers' purpose in processing the text is influenced by the request to rate each story on three scales, in terms of: (a) the writing, (b) interest, and (c) the tone or impression created. One component of this task should involve judging the appropriateness of the concluding statement in terms of the established representation of the story. Semantic coherence would be a minimal requirement, but additional processing should be essential for a qualitative judgment.

To account for increased memory following the metaphoric conclusion, one must assume more or deeper processing (Craik & Tulving, 1975) for the reader to make the qualitative decision in this condition. Epstein, Phillips, and Johnson (1974) provided support for this assumption. In their study, incidental recall for related or unrelated word pairs was assessed under two sets of semantic-processing instructions. Subjects were told to find either a similarity or difference between the words. Recall was greatest when subjects attempted to find a difference between related words or a similarity between unrelated words. This latter process is analogous to finding similarities between the metaphoric conclusion and various macro-propositions that constitute the gist of the story. Interpreting the adequacy of the literal conclusion would be more like finding similarities between related words and thus would entail less processing and result in a poorer memory representation.

The fact that the additional processing hypothesized to account for increased memorability is between the macro-structure and the metaphor is

consistent with the finding that significant differences are present only on the gist or paraphrase scoring. It should be noted that text recall, even in the immediate condition, is not often verbatim. Only about 5% of the idea units are recalled verbatim as opposed to the approximately 20-25% recalled under the gist scoring. Thus, finding any effect of the metaphors on verbatim recall may suffer from floor effects. This is consistent with notion that the more abstract macro-structure plays a key role in prose recall (Kintsch & van Dijk, 1978); in addition, any inferential processing used to draw connections between the metaphor and the macrostructure will be even further removed from the micro-propositional scoring framework used to evaluate subjects' verbatim recall. Thus, only under the more liberal scoring format will such processing be rewarded.

An equally plausible account of the present results can be given using the notion of inferential reconstructive processes that work at retrieval. In this view, information is stored in terms of "fragments of the past (specific memories) and knowledge of the world" (Spiro, 1980). At retrieval, the subject uses the combination of specific memories and world knowledge to reconstruct the remainder of the to-be-recalled information (Bartlett, 1932; Spiro, 1980).

In the current experiment, the metaphors were better recalled than the equivalent literal expression. This may have resulted from either the nature of their initial processing, as argued previously, or because of the uniqueness of the metaphoric statements in a primarily literal paragraph. While these are not completely independent explanations, at least the strongest form of the uniqueness claim runs counter to the Ortony et al. (1978) finding that these context-dependent sentences are as quickly

judged as coherent with the preceding context, whether a metaphoric or literal interpretation is required. The view that the metaphors are well remembered because they appear "out of place" in the passages is also not consistent with subjects' responses on the rating scales for each passage.

Once the metaphors themselves are recalled, for whatever reason, it would then follow that the subjects could use these "specific memories" in combination with their own knowledge to reconstruct the content of the original material. Data from the present research seems to fit nicely with this explanation. The metaphors themselves were better recalled than the literal paraphrases on both the verbatim and the gist levels, suggesting they may have served as the specific memories around which reconstruction occurred. Incidental information was better recalled by the subjects who received metaphors than subjects who received the literal paraphrases at the gist level of scoring only. This finding is reasonable if one assumes that a reconstructive process centered around the metaphors themselves was at work.

A post hoc analysis of the current data provides some support for the reconstructive hypothesis. Under the reconstructive hypothesis if metaphors do act as "specific memories" it would be predicted that if subjects recalled the metaphor itself their recall of the rest of the story should be improved. Further, this should be true for subjects who received metaphors but not for subjects who received literal equivalent statements. A conditional analysis of only those subjects cued by the first phrase of each story showed that subjects receiving stories ending with metaphors and actually recalling the metaphor itself recalled more incidental information than those subjects in the same group who did not recall the

metaphor $t_7 = 2.8$, $p < .05$. The same analysis done on subjects who received the literal equivalent statements revealed no significant difference, $t_7 < 1.6$; hence, there is at least some support for the reconstructive hypothesis in the data.

The present experiment was not designed to test if either of these two explanations best reflects the process by which metaphors interact with text information to produce the greater recall found in this study. More research is needed to establish which of these two explanations (processing vs. retrieval) better reflects the effects that metaphors have on the learning and recall of prose.

The role of the metaphor within the passage may also affect its contribution to memorability. In this study, metaphors served as summary statements and, therefore, their adequacy was judged against the existing macrostructure representation. Metaphors could also serve to clarify some detail of the text or to draw an analogy between an unknown event or procedure and a more familiar idea. In the former case, only a single proposition may benefit from the argument overlap with the metaphor, and thus passage recall will not be greatly affected. In the latter case, a new schema may be introduced in terms of which later information may be interpreted and through which recall strategies can be initiated. Ortony (1979) and Petrie (1979) have elaborated on these functions or metaphor. Depending on the adequacy of the metaphor and the knowledge base of the individual, this analogical usage could have a substantial effect on memory for the text. These functional considerations, along with the processing model, suggest some of the advantages and limitations related to the use of metaphor. Further research is necessary to evaluate these

speculations and to elaborate the role of the metaphor in educational materials.

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Table 1

Mean Proportion of Idea Units

Recalled Using Gist Scoring

	Immediate Recall		Delayed Recall	
	Precue	Postcue	Precue	Postcue
Metaphor	.26 (.10)[a]	.26 (.07)	.07 (.06)	.08 (.09)
Literal	.20 (.07)	.17 (.08)	.02 (.01)	.04 (.02)

[a]Standard deviations are presented in parentheses.

Table 2

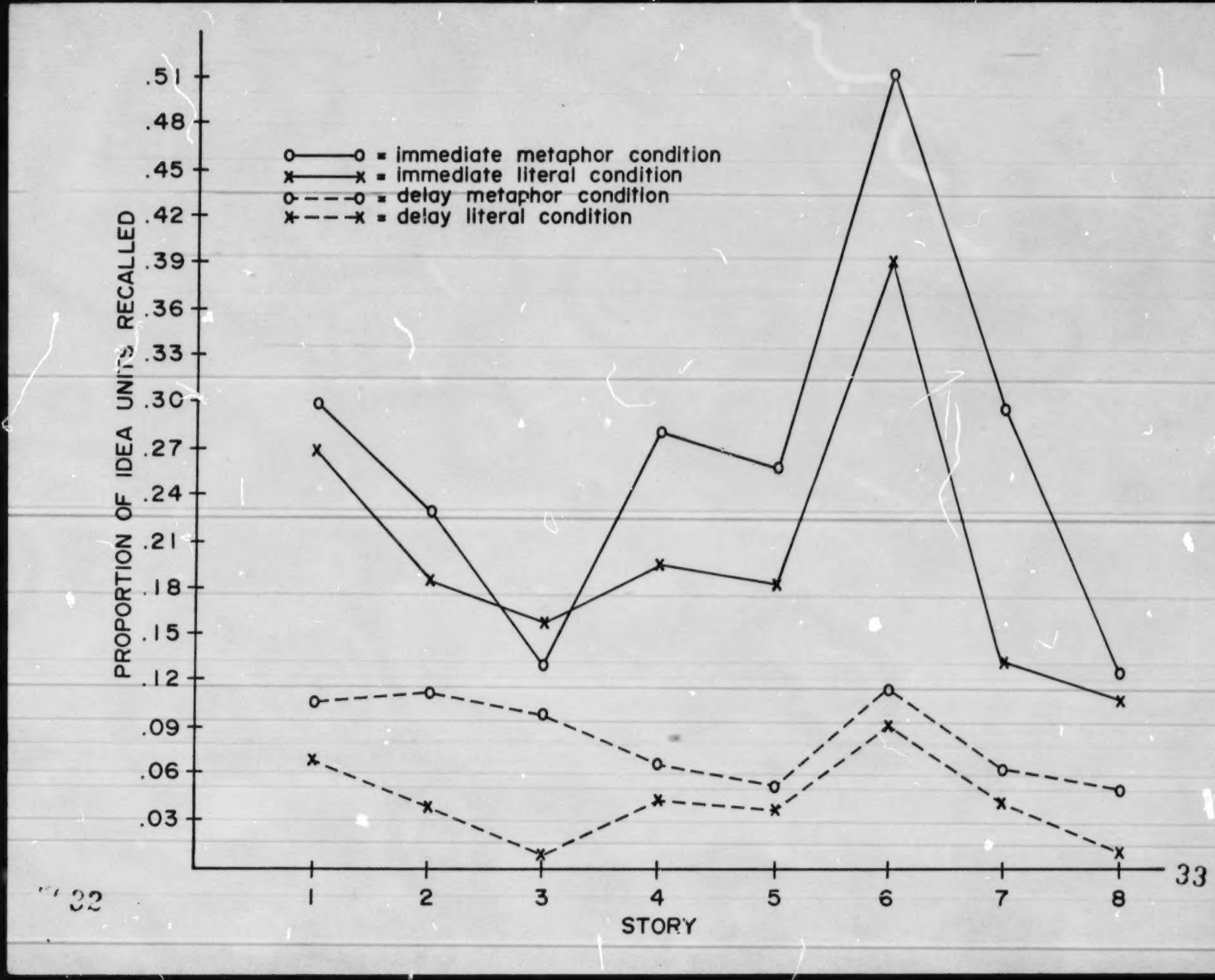
Mean Proportion of Target Sentence Idea Units Recalled Using Gist Scoring

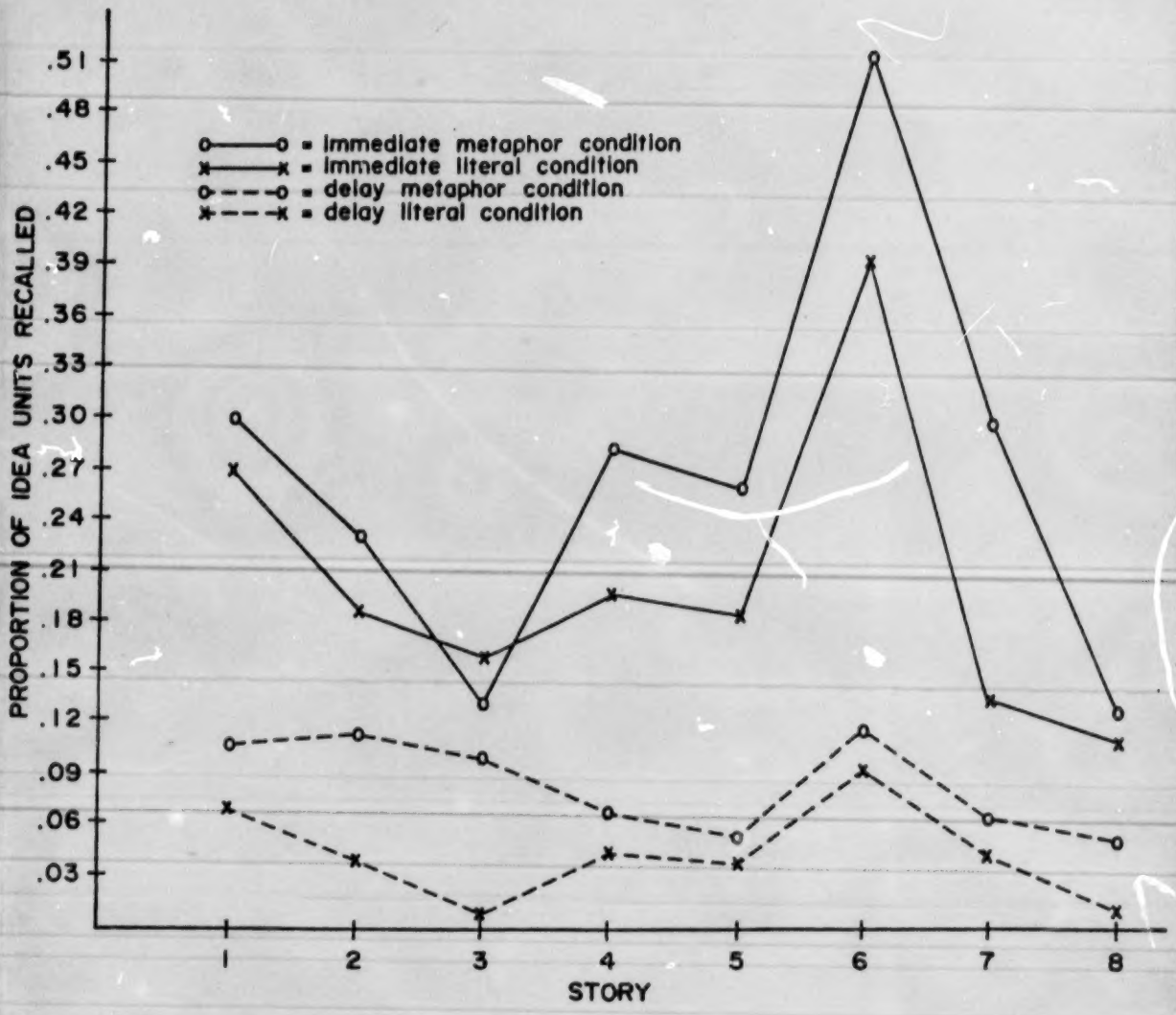
Target Sentence	Recall Interval	
	Immediate	Delayed
Metaphor	.38 (.18)[a]	.08 (.11)
Literal	.17 (.09)	.01 (.05)

[a]Standard deviations are presented in parentheses.

Figure Caption

Figure 1. Idea units recalled for the recall interval by target type by passage interaction.


o——o = immediate metaphor condition
x——x = immediate literal condition
o- - -o = delay metaphor condition
x- - -x = delay literal condition
PROPORTION OF IDEA UNITS RECALLED
.51
.48
.45
.42
.39
.36
.33
.30
.27
.24
.21
.18
.15
.12
.09
.06
.03
1
2
3
4
5
6
7
8
STORY


o——o = immediate metaphor condition
x——x = immediate literal condition
o- - -o = delay metaphor condition
x- - -x = delay literal condition
PROPORTION OF IDEA UNITS RECALLED
.51
.48
.45
.42
.39
.36
.33
.30
.27
.24
.21
.18
.15
.12
.09
.06
.03
1
2
3
4
5
6
7
8
STORY